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Study on in-situ repair technology for different water quality scenic water body

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Abstract

The protection effects of different water sources of scenic water body was studied using three ecological floating bed during stage1 and stage2, in which planted Canna generalis, Acorus calamus and the mixed cropping systems of two plants. A compared system without plant was also carried out. The results showed that all the three planted float systems had a good effect on improving sensory characteristics of studied water body, and higher removal rates of the main water pollutants was obtained. Furthermore, both TN and TP were removed well in the mixed planting system and the values of removal rates of TN, TP were 47.8%, 56.8% and 49.9%, 46.7% in stage1and stage2, respectively. The tested water body in blank control system, however, had little change in experimental period, still be eutrophic, and algae had bloomed in the water tank.

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Keywords: Scenic Water Body, In-Situ Repair Technology, Ecological Floating Bed, Contaminant, Eutrophication

1. Introduction

Urban scenic water body mainly referred to the waterscape of the park, the residential area and the public place. Many of them are slow closed water body, which had poor self-purification and vulnerable to pollution caused algae breeding. The current urban landscape water treatment technologies include physical and chemical methods and engineering measures [1].Although the effect of these methods and measures to purify water is good, but there are still existence of water and power consumption, management of complex, ineffective and other issues. To explore an effective water quality safeguard technology of scenic water body is one of the current hot topics. Ecological floating bed technology is an

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ecological restoration technology in-situ, which is low cost and can continue to remove nitrogen and phosphorus and other water pollutants, and effectively prevents eutrophication[2-6]. In this experiment, we studied the effect of ecological floating bed on improving scenic water quality of two kind of water body by cultivating Canna generalis , Acorus calamus in floating bed.

2. Materials and Methods

2.1. Experimental Methods

The canna generalis and yellow acorus calamus was purchased from the marketplace and cultivated a circle cultivating in advance. Four plastic water tanks were used in this experiment, the dimensions of each tank is 50cm in length, 40cm in width and 35cm in height. And a 40cm × 30cm × 5cm of plastic plate was put on the top of each tank, six holes with 3cm diameter was opened interval of 15cm×15cm, planting one seed per hole with a sponge fixed. The 1# tank without plant as a compared test called blank control system(CK), the 2# and 3# tank planted the canna generalis and the yellow acorus calamus separately. The 4# tank with canna generalis, yellow acorus calamus mixed planting. The experiment was divided into two periods. The first period studied the effect of the planted floating bed system on purifing the water quality of scenic water body. In this study, the tested water was the artificial lake water of a university. The experiment lasted 60 days, from May 12, 2009 to July 9, 2009. The experiment of second period taking the reclaimed water as the replenishment of scenic water body. The tested water was the effluent of wastewater plant mixed artificial lake water by a volume ratios of 1:1. The experimental period was 60 days, from July 10, 2009 to September 8, 2009. The water quality of the tested water was shown in Table 1.

Table 1 The water quality of the tested water /mg•L-1

Items	TN	TP	NH_4^+-N	COD_{Mn}
Lake water(May 12)	4.35	0.44	1.52	6.5
Lake water(July 10)	4.02	0.24	1.35	4.86
recycled water	25.26	0.93	23.4	8.51
Mixed water samples	15.95	0.39	11.8	5.64

2.2. Analysis items and methods

Water quality was measured every 5 days during the experiment, the water which lossed by evaporating and transporting was complemented with distilled water before the water sample was took out of tank. Total Nitrogen was determined by Kjeldahl Method and Titrimetry, total phosphorus was determined by phosphorus vanadium molybdate yellow colorimetric method, NH_4^+-N was determined by spectrophotometry method, COD was determined by potassiumpermanganate method.

3. Results and Analysis

3.1. Removal of TN

The removal of TN by each system was shown in Figure 1. In the floating bed system, the predominant ways of removing TN were the absorption of plant and the nitrification and denitrification[3] of rhizosphere microorganisms. In the early experiments, the effect of settlement of suspended soild was obvious, the value of TN deceased rapidly along with the sedimentation of SS. As time lasting, the effect of settlement weaken gradually and the absorption of nitrogen by plant and the denitrification of rhizosphere microorganisms dominate the removal of TN continuously. The removal rates of TN of CK, Canna generalis , Acorus calamus and mixed planting system were 20.5% , 31.6%, 42.3% and 40.3% stage 1, 61.9% and 51.2%, 47.8% and 49.9% in stage 2, respectively . Obviously, the removal rate of TN in the two stages of the same system were similar, which showed that the main way of removing TN wasn't only by the absorption of plants, but was the adsorption and degradation of microorganisms together.

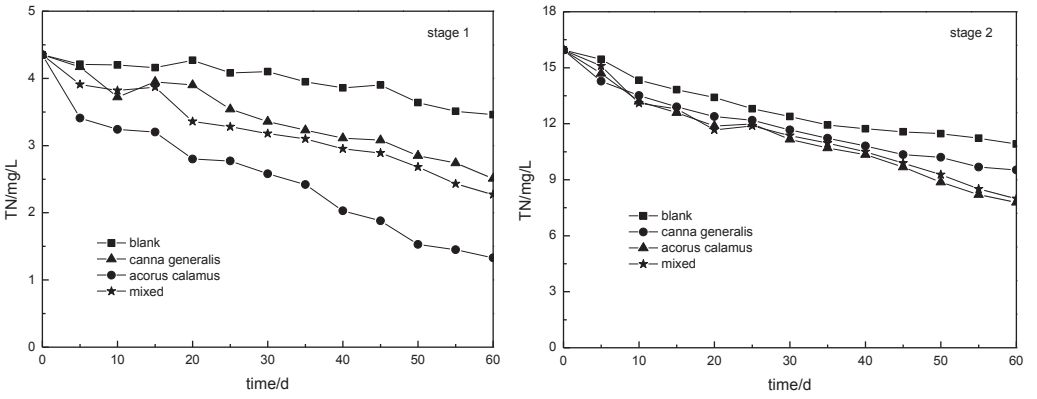

Fig. 1. The variation of TN in two stages with times

3.2. Removal of NH_4^+-N

Figure 2 shows that all of the tested systems had high removal rates of NH4+-N In stage1and stage2.

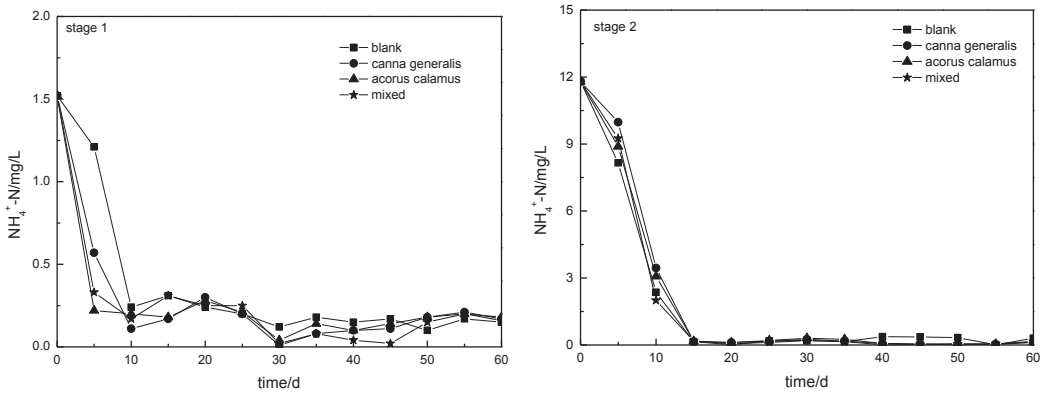

Fig. 2. The variation of NH4+-N in two stages with times

The removal rates of NH4+-N of CK, Canna generalis, Acorus calamus and mixed planting systems were 90.1%, 97.5%, 88.8% and 99.1% in stage 1, 88.2%, 98.8%, 89.5% and 98.7% in stage2, respectively. The removal effect of the planted float system and the blank control system was similar, which showed that the main way of removing NH4+-N was the nitrification, but not the aquatic plants.During the experiment cycle, the value of NH4+-N increased as the plants corruption re-released into the water result in the removal rates of NH4+-N in the planted float systems was lower than the blank control system.

3.3. Removal of TP

The removal rates of TP of CK, Canna generalis , Acorus calamus and mixed planting systems were 34.1% and 79.5%, 70.5% and 46.2% in stage1, 36.4%, 41.0%, 56.8% and 46.7% in stage2, respectively(Figure 3). Previous study had demonstrated that the floating bed plants played an importantrole in the removal of phosphorus and phosphorus was absorbed though assimilation and converted phosphorus into cellular material by plants[4]. The removal rates of TP had a great difference among the four planted float systems in stage1. The best removal efficiency of TP was obtained by Canna generalis system because of more phosphorus could be absorbed by Canna generalis.

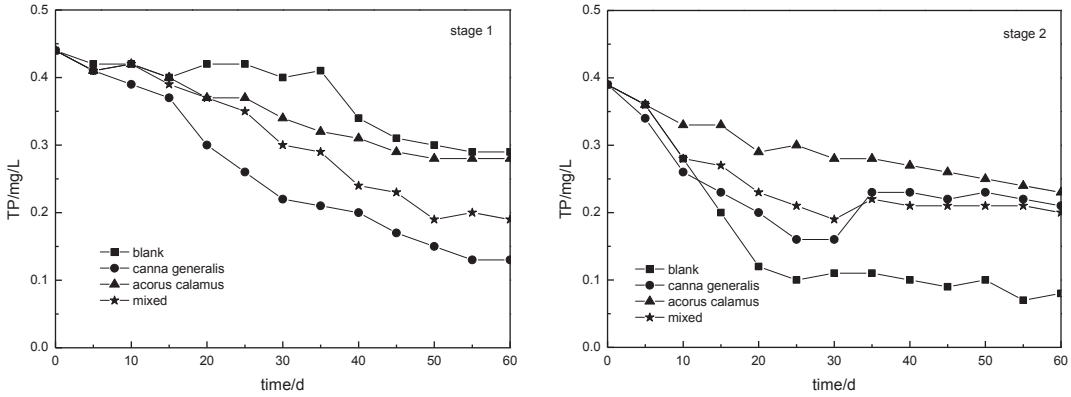

Fig. 3. The variation of TP in two stages with times

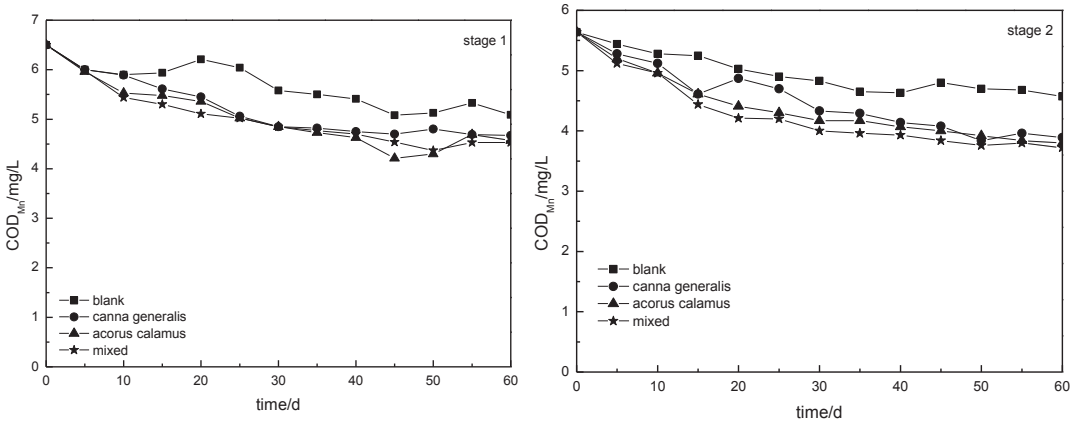

Fig. 4. The variation of CODMn in two stages with times

The removal rates of TP of all the planted float systems were almost similarly in stage2, because the plants had reached the growth peak, the abilities of absorption and assimilation of phosphorus reduced. High concentration of Nitrogen and Phosphorus in the tested water and having no competitor to share the nutrition in CK, as the result of the algae bloomed in the water tank. Therefore, the system of CK also had a good effect on removing TP through algal blooming in the system, especially in stage2, and reached 79.5%.

4. Conclusions

The following conclusion can be obtained in this study：

(1) Water pollutants and nutriment such as nitrogen and phosphorus in various water bodies can be removed well by the plant floating floor system.

(2) The growth of algae can be impeded, at the same time to prevent the eutrophication of water bodies.

(3) Canna generalis and acorus calamus are ornamental plants which either preventing non-point source pollution or beautify the environment.

Acknowledgements

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